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**Q.1** **what is “Hydrological Cycle”? Now-a-days there is general discussion that Hydrological Cycle has been disturbed. Is this a myth or reality? Briefly explain.**

**Hydrological Cycle:**

Water cycle is also known as the hydrological cycle. It is important as it provides our earth with precipitation.



When we hang our wet clothes for drying, do we ever think where does the water from the clothes vanishes? Water actually does not disappear suddenly but only changes from liquid to gaseous state. Similarly during day time different water bodies like river, lakes, stream, oceans give birth to water vapours. This process of change from liquid to gases is known as evaporation. Plants and animals also contributes to this process of evaporation. Animals respires and evaporates , while plants transpires this is called transpiration and the combine term used for the process is evapo-transpiration. These light weighed particles combine with dust and smog to form cloud droplets or crystals of water. The visible mass of clouds is the combination of these liquid droplets. This process is called condensation. These tiny droplets combines with one another until it reaches its peak point and are unable to remain in the atmosphere. This atmospheric water finally reaches the land ,either in the form of rain or snow and we called this process precipitation.it reaches the surface water bodies like river ,ocean or lakes and the process is known as surface runoff .Some amount of water seeps down to give us ground water known as infiltration. And ultimately water returns to where it was early present and completes the water cycle or hydrological cycle.

In addition to it, Hydrological cycle has definitely been disturbed in different ways and it is not a myth but a harsh reality. This is a truly global issue. Forests transport large quantities of water into the atmosphere via plant transpiration. This replenishes the clouds and instigates rain that maintains the forests. When deforestation occurs, precious rain is lost from the area, flowing away as river water and causing permanent drying

Further, Many human activities (e.g., aquifer depletion, wetland drainage) serve to divert water to the ocean that would otherwise have been stored on the continents. Dam building, on the other hand, impounds continental runoff that would otherwise have been transported to and stored in the ocean. The balance between these positive and negative alterations can be used as a measure of net anthropogenic disturbance to the global hydrologic cycle.

Moreover, Large reservoir systems, interbasin transfers, and consumptive water uses such as irrigation are capable of significant and easily identifiable restructuring of natural river flow regimes. There can be substantial changes in long-term net runoff (i.e., precipitation minus evaporation) as well as in the timing and magnitude of downstream peak and low flows. Relative to unregulated rivers, artificial reservoirs have high evaporative losses that reduce net basin runoff. Such losses convey important effects on the water balance, especially in arid and semi-arid areas where freshwater resources are already severely strained. Dry-region impoundments lose significant amounts of water.

To conclude we can say that, a number of human activities can impact on the water cycle: damming rivers for hydroelectricity, using water for farming, deforestation and the burning of fossil fuels, all these factors are continuously contributing to the troubling of hydrological cycle.

**Q 2. Briefly describe “Ground water Sustainability”? How can “Rainwater Harvesting” be linked to ground water sustainability?**

Water is among the most exquisite of natural resources. In many regions of the world, the pressures of economic development are producing a surface-water shortage. Yet in most places, groundwater can be found within a relatively short distance below the ground surface. Groundwater is the portion of the Earth's water cycle that flows underground. Groundwater originates from precipitation that percolates into the ground. Filtration is the flow of water through soil and porous/fractured rock. The general trend is for water in the unsaturated zone to move downward until it reaches the water table. On the other hand, water in the water-logged zone moves primarily along horizontal hydraulic gradients, from higher to lower elevations. The ocean is the natural sink for groundwater flows.

Groundwater is an increasingly important resource for urban and rural potable water supply, irrigated agriculture, and industry, in addition to its natural environmental role of sustaining river flows and aquatic ecosystems. But major changes in land use that impact groundwater are taking place, as a consequence of population growth, increasing and changing food demands, and expanding biofuel cultivation. The link between land use and groundwater has long been recognized, but has not been widely translated into integrated policies and practices. This paper argues that a common understanding of groundwater–land and land–groundwater interaction is needed to facilitate cross-sector dialogue on governance needs and management approaches, targeted at sustaining water resources and enhancing land productivity. Sharply focused land-use management measures can produce significant groundwater quality and quantity benefits at relatively modest cost and improving integrated governance will be crucial to ensuring an acceptable harvest of both food and groundwater from the available land. This paper outlines available technical tools to identify priority land areas for groundwater protection and appraises institutional and policy provisions to allow their application.

In addition to it, Rainwater harvesting is a type of harvest in which the rain drops are collected and stored for the future use, rather than allowing them to run off. Rainwater can be collected from rivers or roofs and redirected to a deep pit (well, shaft, or borehole), aquifer, a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for gardens, livestock,[1] irrigation, domestic use with proper treatment, indoor heating for houses, etc. The harvested water can also be used as drinking water, longer-term storage, and for other purposes such as groundwater recharge. Rainwater harvesting is essential because Surface water is inadequate to meet our demand and we have to depend on ground water .Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished.

**Q3. What “Quality Parameters” should be considered in designing water supply system for a community?**

Since the industrial revolution in the late eighteenth century, the world has discovered new sources of pollution nearly every day. So, air and water can potentially become polluted everywhere. Little is known about changes in pollution rates. The increase in water-related diseases provides a real assessment of the degree of pollution in the environment. We will summarizes water quality parameters for a community.

A wide range of water quality parameters are monitored within the Lower Lakes with key parameters reported herein being pH, alkalinity, salinity, turbidity, nutrients (total nitrogen and total phosphorus), chlorophyll a and metals (aluminium and iron). A brief description of these parameters and typical historical (pre-drought) levels are provided below:

pH is an indicator of acidity or alkalinity. pH is a logarithmic scale and an increase or decrease of one pH unit is a 10 fold change. Neutral water has a pH of 7, acidic solutions have values between 0-6 and alkaline solutions have values between 8-14. Prior to the current drought, the pH in the region was typically between 7 and 9.

Alkalinity is a measure of the buffering capacity of water, or the capacity of the water to neutralise acids and resist pH change. Alkalinity within water bodies is consumed as acid is released from acid sulfate soils. Adding limestone contributes alkalinity to waters, helping to neutralise any acid released from the sediments. Historically, alkalinity levels within this region have been between 80 and 250 mg/L as CaCO3.

Salinity is a measure of the amount of dissolved salts in the water. Saline water conducts electricity more readily than freshwater, so electrical conductivity (EC) is routinely used to measure salinity. As salinity increases, it may become toxic to native freshwater organisms. Prior to drought conditions, salinity was on average less than 700 (EC) μS/cm in Lake Alexandrina (at Milang) and less than 1600 (EC) μS/cm in Lake Albert (at Meningie). Seawater has a salinity of approximately 55,000 (EC ) μS/cm.

Turbidity is a measure of the cloudiness or haziness in water caused by suspended solids (eg sediment, algae). Turbidity is expressed in Nephelometric Turbidity Units (NTU) and is measured using a relationship of light reflected from a given sample. Turbidity is very variable in the Lower Lakes and influenced primarily by wind events.

Nutrients–Total nitrogen (TN) and total phosphorus (TP) are the total amount of nitrogen and phosphorus present in the water body. Nitrogen can be present in different forms (e.g. organic nitrogen in plant material, ammonia, nitrate and nitrite). Phosphorus can also be present in different forms (eg organic phosphorus, phosphate). High concentrations of phosphorus and nitrogen can result in excessive growth of aquatic plants such as cyanobacteria, phytoplankton, macrophytes and filamentous algae.

Last but not the least ,Metal concentrations in the Lower Lakes allow us to determine what processes are proceeding within sediments. During concentration events (ie evaporation and low inputs) the concentration of metals are expected to increase, alternatively during flooding events the volume of metals will be diluted and expected to reduce. In addition to this, where acid sulfate soils are present, as the sediments acidify and the pH is reduced, metals that have been previously unavailable and bound up within sediment are liberated. This increase in metal concentration can be used as an indicator of acid sulfate soil impacts.